

LARVAL DESCRIPTION OF *ABARIS BIGENERA*
BATES, 1882, AND NOTES ON RELATIONSHIPS OF THE
GENUS *ABARIS* DEJEAN, 1831
(COLEOPTERA: CARABIDAE: PTEROSTICHINI)

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Abstract.—The three larval instars of the Neotropical *Abaris bigenera* Bates, 1882, are described. Based on this first larval description for the genus, *Abaris* larvae share two synapomorphies—extremely short coronal suture, and ventrally extended membranous band on the maxillary stipes—with the Mediterranean pterostichine genus *Orthomus* Chaudoir, 1838, suggesting that they are closely related.

The genus *Abaris* Dejean, 1831, is a small New World genus belonging to the large and complex tribe Pterostichini. It includes nine species that range from Arizona and southeastern California south to Brazil. Only one species, *Abaris splendidula* (LeConte, 1863), has been found north of Mexico.

Little is known about the taxonomy and bionomics of *Abaris* species. Straneo (1939) wrote a key to the species excluding *A. splendidula*, and Bousquet (1984) redescribed *A. splendidula* and compared it with the other Mexican species. Larvae of *Abaris* were previously unknown.

This paper describes the larvae of *A. bigenera* Bates, 1882, and briefly discusses the relationship of the genus. *Abaris* is the first Neotropical Pterostichini genus-group taxon to be described in its larval stage.

MATERIALS AND METHODS

The description of *Abaris bigenera* Bates is based on 16 larvae (5L₁, 5L₂, 6L₃) reared *ex ovo* from adults collected at 18.3 km S Guelatao, Oaxaca, Mexico. Larvae are deposited in the Canadian National Collection of Insects and Arachnids, Ottawa, and Cornell University Insect Collection, Ithaca (Lot No. JKL-88H16.5).

Larvae were cleared in hot 10% KOH, impregnated with glycerine (see Goulet, 1977), and studied with an interference contrast microscope at 100–400×.

Terms used for structures have been explained previously (Bousquet, 1985); notation of primary setae and pores follows Bousquet and Goulet (1984), and notation of secondary setae follows Bousquet (1985).

Larvae of the following pterostichine genus-group taxa were available for comparison: *Orthomus* Chaudoir, *Poecilus* Bonelli, *Derus* Motschulsky, *Lophoglossus* LeConte, *Gastrellarius* Casey, *Stereocerus* Kirby, *Myas* Dejean, *Lagarus* Chaudoir, *Argutor* Dejean, *Bothriopterus* Chaudoir, *Melanius* Bonelli, *Pseudomaseus* Chaudoir, *Monoferonia* Casey, *Platysma* Bonelli, *Morphnosoma* Lutshnik, *Abacidus* LeConte,



Fig. 1. Dorsal habitus of *Abaris bigenera*, L₃.

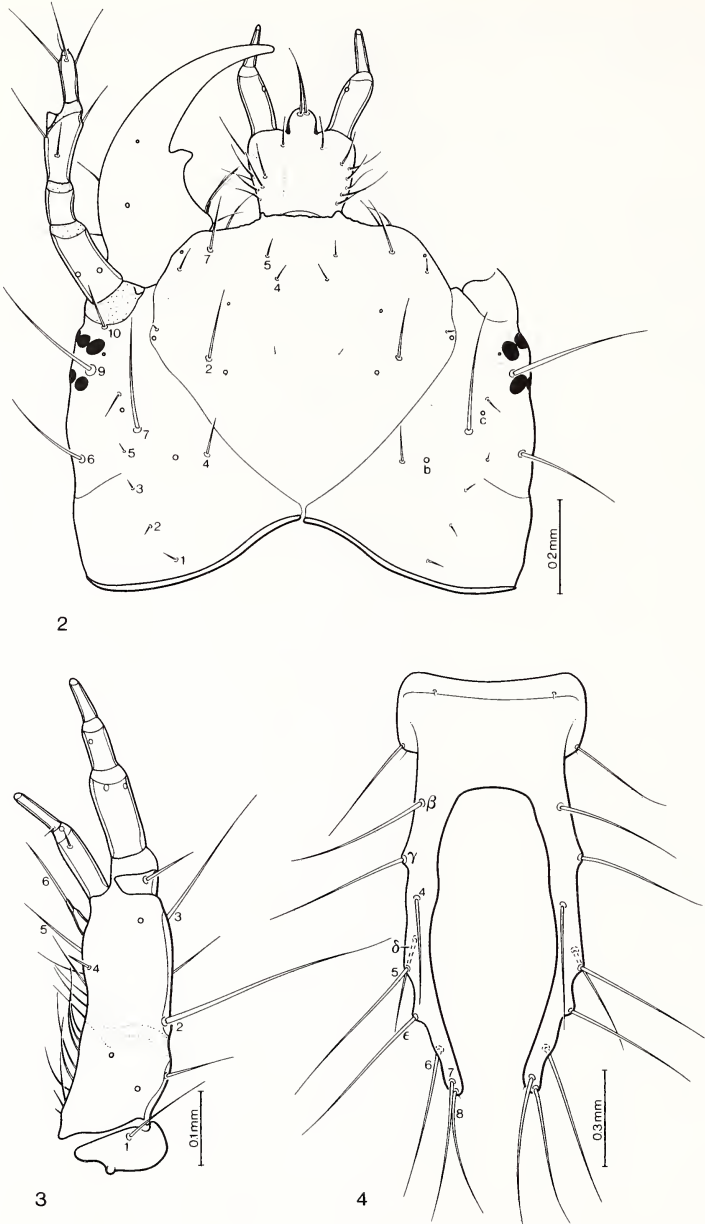
Steropus Dejean, *Feronidius* Jeannel, *Cylindrocharis* Casey, *Oreophilus* Chaudoir, *Hypherpes* Chaudoir, *Cryobius* Chaudoir, *Cyclotrachelus* Chaudoir, *Abax* Bonelli, and *Molops* Bonelli.

LARVAL DESCRIPTION OF *ABARIS BIGENERA* BATES

Diagnosis. Larvae of *Abaris bigenera* differ from those of other known New World Pterostichini by the absence or extreme reduction of the coronal suture (Figs. 1, 2). This character state occurs in several groups of Platynini whose larvae are structurally similar to those of Pterostichini. Larvae of *A. bigenera*, however, differ from those of Platynini by the apically acuminate lacinia in combination with the membranous area extended over the ventral side of the stipes in second and third instars (Fig. 3).
Description. *First instar.* With the characteristic features of the tribe Pterostichini as outlined by Bousquet (1985), plus the following. **Head width:** 0.47–0.49 mm. **Microsculpture:** Frontale, parietale, and pronotum without microsculpture. Mesonotum and metanotum with multipointed microsculpture over anterior third of posterodiscal area. Tergites I–IX with multipointed, in part pointed laterally, microsculpture all over posterodiscal area (though very sparse on posterior half of first tergite). Urogomphi with pointed microsculpture all over. **Chaetotaxy:** Adnasale, prementum, and femur without additional setae. Seta FR_2 on frontale long; seta FR_4 anterior to level of FR_c . Seta PA_4 on parietale 0.2–0.3 × length of PA_7 ; PA_5 very small, subequal in length to PA_1 – PA_3 ; seta PA_6 0.3–0.4 × length of PA_7 ; pore PA_b on parietale lateral to level of PA_4 . Length of seta MX_6 on lacinia subequal to that of MX_5 ; setal group gMX with about 30 setae. Setae PR_3 and PR_{11} on pronotum distinct; seta PR_{12} distinct, its length about 0.7 × that of PR_{11} . Setae ME_{12} on mesonotum and metanotum distinct; seta ME_{13} distinct, its length 0.6–0.7 × that of ME_{12} . Setae TE_1 , TE_6 and TE_7 on tergites I–VII subequal in length; seta TE_{10} on abdominal tergite I–VIII distinct, its length 0.7–0.9 × that of TE_9 . Seta UR_2 on abdominal tergite IX at least 7 × longer than UR_3 . Urogomphus with 5 long setae (UR_4 – UR_8). **Head:** Nasale more or less straight. Egg-bursters not extended to level of seta FR_2 , consisting of about 5 microspinulae. Frontal suture between levels of FR_2 and egg-bursters oblique; coronal suture absent. Parietale with 6 ocelli on each side. Cervical sulcus present, extended dorsally to level of seta PA_7 . Antennomere I without membranous area near base. Mandible moderately curved; retinaculum narrow; medial margin of terebra smooth. Stipes 1.8–1.9 × as long as wide; membranous area restricted to lateral side of stipes; length of maxillary palpomere II 1.6–1.7 × that of palpomere III. Ligula well developed. **Legs:** Claws subequal in length. **Abdomen:** Urogomphi slightly curved medially in apical half. Abdominal pleura without additional sclerite in front of epipleurite.

Second instar. Similar to third instar except for the following states. **Head width:** 0.64–0.65 mm. **Head:** Antennomere I about 2 × longer than antennomere II, about 1.1 × longer than antennomere III, and about 1.3 × longer than antennomere IV. Stipes 2.1–2.2 × as long as wide.

Third instar. With the characteristic of the tribe Pterostichini, as outlined by Bousquet (1985), plus the following. **Head width:** 0.97–0.98 mm. **Microsculpture:** Frontale, parietale, pronotum, mesonotum, metanotum, and abdominal tergites I–IV without distinct microsculpture pattern; tergites V–VII with faint, sparse, progressively more



Figs. 2-4. *Abaris bigenera*, L₃. 2. Cephalic capsule, prementum and labial palps, left mandible, and left antenna (dorsal view). 3. Left maxilla (ventral view). 4. Abdominal tergite IX and urogomphi (dorsal view).

developed pointed microsculpture anterolaterally on posterodiscal area; tergite VIII with faint, pointed to multipointed microsculpture over entire posterodiscal area. Urogomphi with pointed microsculpture all over, sparser apically. *Chaetotaxy*: Adnasale with 2 setae (FR₈–FR₉). Seta FR₂ on frontale long; seta FR₄ anterior to level of FR_c. Seta PA₄ on parietale 0.1–0.2 × length of PA₇; PA₅ very small, subequal in length to PA₁–PA₃; seta PA₆ 0.4–0.6 × length of PA₇; pore PA_b on parietale lateral to level of PA₄. Antennomere I and II without setae. Mandible with 2 lateral setae (MN₁ and MN_a). Length of seta MX₆ on lacinia 0.8–1.0 × that of MX₅; setal group gMX with less than 50 setae. Setae PR₃ and PR₁₁ on pronotum distinct; seta PR₁₂ also distinct, its length 0.8–1.0 × that of PR₁₁. Seta ME₁₂ on mesonotum and metanotum distinct; seta ME₁₃ also distinct, its length 0.8–1.0 × that of ME₁₂. Tibia without secondary setae. Abdominal tergites I–V without numerous secondary setae; seta TE_a distinct on abdominal tergites I–VII. Seta UR₂ on abdominal tergite IX (Fig. 4) at least 7 × longer than UR₃. Urogomphus (Figs. 1, 4) with 9 long setae (UR₄–UR₈, UR_β, UR_γ, UR_δ, UR_ε). *Head*: Nasale more or less straight (Figs. 1, 2). Coronal suture extremely short, more or less distinct. Parietale with 6 ocelli on each side. Ocular sulcus absent. Cervical groove present, not extended laterally beyond level of PA₁₅. Antennomere I without membranous area near base; antennomere I about 1.7 × longer than antennomere II, about 1.2 × longer than antennomere III, and about 1.7 × longer than antennomere IV. Mandible moderately curved; penicillus present; retinaculum narrow; medial margin of terebra smooth. Stipes (Fig. 3) 2.4–2.5 × as long as wide; membranous area extended over entire width of ventral side of stipes (though less distinct medially); length of maxillary palpomere II 1.9–2.0 × that of palpomere III. Ligula well developed. *Legs*: Claws subequal in length. *Abdomen*: Urogomphi less than 4 × as long as tergite IX, slightly curved medially in apical half. Abdominal pleura without additional sclerite in front of epipleurite.

Life cycle data. Three adults (2♀♀, 1♂) were collected in the field on 16 August 1988, and maintained in a cooler until returned to the laboratory about one week later. In the laboratory, adults were maintained at 13:11 L : D at 22°C day, 20°C night, and fed mealworm chunks 2–3 days/week. The first L₁ larvae were seen 5 September and the last of the 16 was first observed on 6 October.

The average duration of the first instar under the same environmental and feeding regime was 5.6 days (N = 12). The duration of the second instar averaged 7 days (N = 6). No third instar larvae were reared to the pupal stage.

DISCUSSION

Relationships of *Abaris* have never been addressed. Bates (1882:85) noted that the Mexican and South American *Pseudabarys* Chaudoir, 1873 are “very closely allied to *Abaris*.” He also stated about *Pseudabarys* that “its nearest ally in the New World is probably *Ophryogaster*.” Bates further reported the comments of Chaudoir (1873: 99) considering *Pseudabarys* closely related to the Mediterranean genus *Orthomus* Chaudoir and the Australian genera *Simodontus* Chaudoir and *Ceneus* Chaudoir (regarded today as a junior synonym of *Prosopogmus* Chaudoir).

In most recent classifications, such as Csiki (1930), Reichardt (1977), and Straneo (1977), *Abaris* is placed near *Abaridius* Chaudoir and *Pseudabarys*. *Abaridius* com-

prises a single species from Brazil that was originally described as a member of *Abaris*, and *Pseudabarys* includes seven species from Mexico and South America.

Compared with larval stages of the taxa studied, *Abaris* larvae are phenetically very similar to those of *Orthomus*. More importantly, *Orthomus* larvae have no (L_1 and L_2) or an exceedingly short (L_3) coronal suture, a character state elsewhere found among pterostichines only in *Abaris*. Also within *Orthomus* larvae, the ventral membranous area of the stipes extends over the entire width in L_2 and L_3 , a configuration shared with *Abaris* larvae. In other pterostichine larvae, the membranous area of the stipes is either lateral, or extends ventrally only on the lateral half of the stipes, very rarely over the entire width. Occurrence of these two character states, i.e., short to absent coronal suture and extended membranous area of stipes, both likely synapomorphic, suggests that *Abaris* is closely related to the genus *Orthomus*. All other character states of *Abaris* and *Orthomus* larvae, except for a few such as the microsculpture and egg-burster shape in which the transformation polarity is difficult to assess, are probably plesiomorphic for the Pterostichini.

The genus *Orthomus* is restricted to the Mediterranean region and includes about 30 species assigned to five subgenera, *Orthomus sensu stricto*, *Nesorthomus* Bedel, *Eutrichopus* Tschitschérine, *Wolltinerfia* Machado, and *Trichopedius* Bedel. Several of these taxa are ranked as genera by some authors.

Arndt and Hurka (1990) suggested that *Orthomus* could be closely related to the Holarctic taxon *Lagarus* (considered a subgenus of *Pterostichus* Bonelli by most authors) based on larval states of straight nasale and long seta MX_6 . Both features also occur in larvae of *Abaris* as well as in many other pterostichine taxa and, in our opinion, are plesiomorphic for pterostichines. Furthermore, adult structures indicate that *Orthomus* and *Lagarus* are not closely related. *Lagarus* belongs to a large clade composed of several genus-group taxa including *Pterostichus*; the clade is autapomorphic for the presence of a transverse apophyse on the left paramere (Bousquet, unpubl.). Members of *Orthomus* and *Abaris* have no such apophyse on the left paramere.

Larvae of the Neotropical genera *Abaridius* and *Pseudabarys*, and of the Australian *Simodontus* and *Prosopogmus* are unknown.

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